ACTIVE SEAL ASSISTED LATCHING ASSEMBLIES

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application relates to and claims priority to U.S. Provisional Application No. 60/552,781 entitled "Active Seal Assemblies" and filed on Mar. 12, 2004, the disclosure of which is incorporated by reference herein in their entirety.

BACKGROUND

[0002] This disclosure relates to seals and more particularly, to active seal assisted latching assemblies that employ active materials to effect the latching.

[0003] Current methods and assemblies for latching and sealing opposing surfaces such as doors and trunk lids, for example, include the use of flexible elastic membranes and/or foam structures that conform upon pressing contact of the opposing surfaces to fill the gap between the surfaces where the seal is required and a separate latching mechanism. Typical materials for the seal include various forms of elastomers, e.g., foams and solids that are formed into structures having solid and/or hollow cross sectional structures. The geometries of the cross sections are varied and may range from circular forms to irregular forms having multiple slots and extending vanes. Current typical latching methods include mechanical assemblies that engage and disengage the two parts that need to be latched or unlatched.

[0004] Sealing assemblies are typically utilized for sound and/or fluid (gasses or liquids) management. These seals generally are exposed to a variety of conditions. For example, for vehicle applications, door seals generally are exposed to a wide range of temperatures as well as environmental conditions such as rain, snow, sun, humidity, and the like. Current materials utilized for automotive seals are passive. That is, other than innate changes in modulus of the seal material due to aging and environmental stimuli, the stiffness and cross sectional geometries of the seal assemblies cannot be remotely changed or controlled.

[0005] For example, traditional passive door seal design must compromise between functional adequacy and user's ease of operation. Typically, improved sealing results from greater contact area and adequate pressure over the seal length. This approach generally increases the force required from the user to close the door as compared to less seal contact area and pressure. Additionally, manufacturing tolerances which vary over the perimeter of the doors may require a greater seal compression over the length of the seal than is necessary to ensure that the point of the door located the furthest from the door hinge will have adequate sealing area and pressure to prevent moisture or noise from entering the vehicle. This may result in more total compression and force over the entire door than is necessary, thus increasing the required door closure force. In addition, general manufacturing issues including interactions of various components involved in sealing technologies may result in increased manufacturing cycle time due to the necessity to redesign the seal to match vehicle conditions.

[0006] Typical latching methods are mechanical assemblies that involve linkages, pivots, and other mechanical parts that engage and disengage to latch or unlatch the two parts, for example a car door to the car doorframe. The latching mechanism may be a manual, or an electrically powered mechanism such as used for keyless entry in most modern automobiles. Both mechanisms involve a large number of moving mechanical parts, manually or electrically actuated to latch or unlatch, for example an automobile door. These assemblies, whether manually or electrically actuated, can occupy significant space, for example with in the door of an automobile, and freuquently require periodic maintenance such as lubrication.

[0007] Accordingly, it is desirable to have active seal assemblies that can be controlled and remotely changed to alter the seal effectiveness, wherein the active seal assemblies change material properties on demand, for example stiffness, elastic modulus, or change in geometry, for example, by actively changing the seal cross-sectional shape. In this manner, in seal applications such as the vehicle door application noted above, door opening and closing efforts can be minimized yet seal effectiveness can be maximized. Furthermore, it is desirable that the active seal assists in the latching of the two surfaces that need to be sealed.

BRIEF SUMMARY

[0008] Disclosed herein are active seal assisted latching assemblies that employ active materials to effect the sealing, latching and methods of use. In one embodiment, a latch for latching two surfaces comprises a latch comprising an engageable portion; a seal structure comprising an active material, wherein the active material is effective to undergo a change in shape in response to an activation signal, wherein the change in shape causes the seal structure to seal and latch with the engageable portion; an activation device in operative communication with the active material adapted to provide the activation signal; and a controller in operative communication with the activation device.

[0009] In another embodiment, a latch for latching a first surface to a second surface comprises a first surface comprising a first member extending from the first surface, wherein the first member comprises an active material, wherein the active material is effective to undergo a change in shape in response to an activation signal; a second surface comprising a second member extending from the second surface, wherein the second member comprises the active material, and wherein the second surface and the second member are positionally disposed in an opposing relationship to the first surface and the first member; an activation device in operative communication with the active material adapted to selectively provide an activation signal to the active material, wherein the activation signal effects a change in the shape of the active material and engages the first member with the second member; and a controller in operative communication with the activation device.

[0010] In yet another embodiment, a latch for latching two surfaces comprises a first surface comprising a first member extending from the first surface, wherein the first member comprises an active material effective to undergo a change in shape in response to an activation signal; a seal structure formed of an elastic material disposed on a second surface, wherein the seal structure and second surface are aligned with the first member and first surface such that the first